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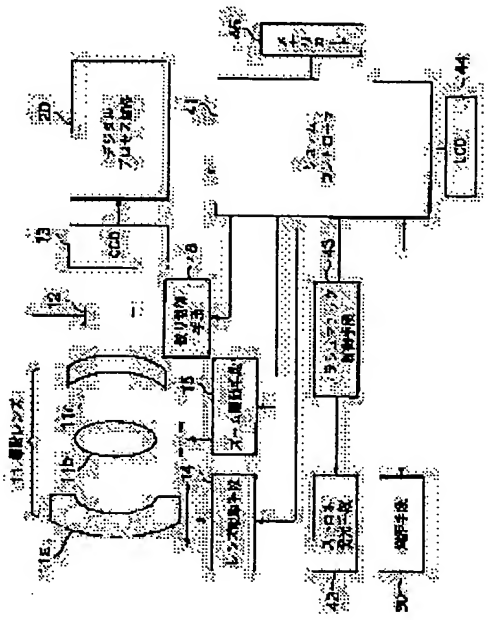
(54) AUTOMATIC FOCUSING DEVICE FOR ELECTRONIC CAMERA

(57)Abstract:
PROBLEM TO BE SOLVED: To realize automatic focusing at high speed with high precision by adopting a simple constitution to solve the problem that it takes time for focusing and precision cannot be secured in the case of a low luminance or a low contrast in the contrast system.
SOLUTION: An automatic focusing device for electronic camera is provided with a photographic leans 11 which forms a subject image, a CCD imaging device 13 which converts the subject image formed by the photographic lens 11 to a picture signal, an active trigonometrical distance measurement mechanism 30 which throws light to a subject to measure an objective subject distance, and a focusing mechanism 20 in the contrast system which uses a high frequency component of an output signal in the center area of the imaging device 13 to perform focusing, and the photographic lens 11 is driven on the basis of the focusing means in the contrast system to perform focusing after being driven to a position a certain extent short of an in-focus position measured by the mechanism 30.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] An automatic-focusing adjustment of an electronic camera characterized by providing the following A taking lens for carrying out image formation of the photographic subject image An image sensor for changing into a picture signal a photographic subject image by which image formation was carried out with said taking lens An active triangular ranging means to project light on a photographic subject and to measure the target photographic subject distance A taking-lens drive control means which drives said taking lens based on a focus means by contrast method which performs a focus using a high frequency component of an output signal in predetermined area of said image sensor, and a focus means according to said contrast method after driving said taking lens in a location of a specified quantity front focus or rear focusing to a focus location measured by said active triangular ranging means, and performs a focus
[Claim 2] An automatic-focusing adjustment of an electronic camera characterized by providing the following A taking lens for carrying out image formation of the photographic subject image An image sensor for changing into a picture signal a photographic subject image by which image formation was carried out with said taking lens A photographic subject brightness detection means to detect brightness of a photographic subject An active triangular ranging means to project light on a photographic subject and to measure the target photographic subject distance, A focus means by contrast method which performs a focus using a high frequency component of an output signal in predetermined area of said image sensor, When it judges that brightness of a photographic subject is high brightness more than predetermined with said photographic subject brightness detection means After driving said taking lens in a location of a specified quantity front focus or rear focusing to a focus location based on a ranging output of said active triangular ranging means When it judges that said taking lens is driven based on a focus means by said contrast method, a focus is performed, and photographic subject brightness is low brightness below a predetermined value A taking-lens drive control means which drives said taking lens in a focus location based on a ranging output of said active triangular ranging means, and performs a focus
[Claim 3] Said photographic subject brightness detection means is the automatic-focusing adjustment of an electronic camera according to claim 1 or 2 characterized by being what detects brightness of a photographic subject based on an output signal of said image sensor.
[Claim 4] An amount of said front focus or rear focusing is the automatic-focusing adjustment of an electronic camera according to claim 1 or 2 characterized by being an amount depending on a focal distance or a drawing value of a taking lens at the time of photography.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] Especially this invention relates to the automatic-focusing adjustment of the electronic camera equipped with the image sensor with respect to an automatic-focusing adjustment.
[0002]
[Description of the Prior Art] Conventionally, the image data of the area of the predetermined portion on the image sensor (on behalf of an image sensor, hereafter referred to as "CCD") with which image formation of the photographic subject image by which incidence is carried out through a taking lens as an automatic-focusing adjustment of an electronic camera is carried out is read for every predetermined drive unit of a lens, and the so-called mountain-climbing method (one of the contrast methods) of driving a lens is adopted as the location where the contrast becomes the maximum.
[0003] However, this method has some following troubles.
[0004] ** At the time of low brightness, focus time amount becomes extremely long. From the principle of a mountain-climbing method, unless pinpointing of a photographic subject location is after scanning all lens drive ranges, it is impossible. And 1 time per predetermined drive unit of a lens of the CCD reset time is required, and there was a problem of becoming such extremely long time amount that focus time amount exceeding 1 second, at the time of the low brightness to which the CCD reset time becomes longer than 1/15 second. Furthermore, since CCD sensitivity falls so that the number of pixels generally increases, in the electronic camera which pursues photograph image quality, the above-mentioned problem appears [to which the CCD reset time is becoming long steadily] notably.
[0005] ** When contrast was low, the peak of contrast was not caught, but it became focus impossible, and there was a problem of spoiling the feeling of actuation of a camera remarkably.
[0006] ** Compared with the film-based camera, on relation with a small area of an image pick-up side, since the focal distance of a taking lens was short, depth of field of the electronic camera were very deep, and it had the problem that photographic subject distance with available precision level effective in flash plate MACHIKKU was undetectable, by the mountain-climbing method. This problem appears so notably that the focal distance of a taking lens is on a wide side.
[0007] In order to solve the problem of the focus time amount of the above-mentioned **, AF sensor is arranged near the schedule focal plane where image formation of the photographic subject image is carried out, and in the order location, and the method which detects the amount of defocusing and its direction from the contrast difference of each AF sensor, and performs a lens drive is opened to JP,55-155308,A. However, this is the technology in the film-based camera which can tune up electrical characteristics and the optical layout of CCD only to AF sensors, and an image pick-up element element cannot apply it to the electronic camera which is making CCD as an AF sensor serve a double purpose.
[0008] AF method with which the classes of a contrast method and phase contrast method differ is used together in JP,7-43605,A, a phase contrast method performs coarse control to it, a contrast method performs fine control to it, and the technique to which focus actuation is carried out is opened to it. However, the automatic focusing device indicated by this official report needs to be

specially equipped with the area sensor for a contrast method other than AF equipment of a phase contrast method on the assumption that a film-based camera, and cost becomes high while equipment is enlarged. Moreover, the congruence method put together here cannot solve the low contrast problem of **.

[0009] Moreover, neither the case where an object exists far away, nor quantity of light bright [in the perimeter] and sufficient, at the time of low contrast is obtained, and this is ineffective [in order to solve the problem of focus time amount and the low contrast problem of ** in the low brightness of **, the active method with which a fill-in flash is floodlighted and the weak spot of a passive method is compensated is well-known, but], if an object is not a short distance comparatively.

[0010] In order to raise the effect of an active method, when fill-in flash reinforcement is raised, the power consumption for floodlighting becomes immense and free is a problem at an electronic camera to be reduced [of power consumption]. (From the first, by the mountain-climbing method, fill-in flash floodlighting must be theoretically continued among lens drive time amount, and, unlike a film-based camera, the power consumption cannot be disregarded with an electronic camera.) It is necessary to put the spectrum of a fill-in flash into a visible region for image sensor combination, and mischievous optical power-up gives [the person taken a photograph] pain, such as being dazzling, and is not desirable again.

[0011] Moreover, there is technique of pinpointing the bottom of combination and the unique condition of each method in order to compensate the weak spot of two methods where an active method differs from a passive method, as one of the technique of solving the above-mentioned problem, and using it alternatively as described at JP,9-325262,A. However, unlike a film-based camera, an electronic camera is the following called focus equipment of image sensor combination. (1) - (4) A restriction peculiar to an electronic camera [like] exists.

[0012] (1) Since there is a problem of image quality, the sensitivity rise of an image sensor cannot be performed simply.

(2) Since there is a problem of image resolution, an optimal setup of the magnitude which is a pixel cannot be carried out for AF.

(3) A spectral region cannot be optimized because of a RGB filter and an infrared cut-off filter.

(4) Since full-screen read-out is required, the optimum design of the image sensor read-out speed cannot be carried out to AF.

[0013] For this reason, it is difficult to optimize an image sensor as the distance measuring equipment thru/or focus equipment of a passive mold also optically and electrically including a layout like a film-based camera, and an extensive improvement of focus equipment cannot be desired only by the technique only alternatively used like the conventional technology.

[0014] In the method which performs coarse control with an active triangular ranging method, and performs fine control with a contrast method on the other hand, when it was incompletely projected on light by the photographic subject in the active triangular ranging method, there was fault which outputs extreme short-distance data and long distance data, for this reason there was a problem which the situation where the peak of contrast does not exist generates in lens drive within the limits of the predetermined range based on the ranging output of an active triangular ranging method.

[0015] Furthermore, the so-called parallax from which the projection location of the light by the active triangular ranging method and the location of the focal detection area of CCD by the contrast method differ with photographic subject distance arose, and there was a problem that the situation where a contrast peak cannot be caught occurred.

[0016] Moreover, when incompletely projected on the case where it is incompletely projected on an infrared beam on left-hand side to a photographic subject, and right-hand side (it happens when it is projected on light near [the] a boundary in the photographic subject of far and near coexistence) Since the photographic subject distance which completely shifted to hard flow is outputted to the so-called problem of a spot chip When a taking lens was driven in the predetermined range based on a contrast method after the focus by the active triangular ranging method, the peak location of contrast could not be pinpointed but there was a problem that focus time amount became long on the contrary.

[0017] Although what is necessary is just to take the large width of face of the above-mentioned predetermined range with allowance as a cure in such a case in order to catch the peak of contrast

certainly, it will be contradictory to take this large for the purpose of shortening original focus time amount.

[0018]

[Problem(s) to be Solved by the Invention] Thus, when the contrast method was conventionally adopted in the automatic-focusing adjustment of an electronic camera, the problem that precision was not securable for the bottom of the problem that a focus takes time amount, low brightness, or low contrast was caused.

[0019] It is in this invention having been made in consideration of the above-mentioned situation, and a focus taking time amount by the contrast method, solving the problem that precision is not securable for the bottom of low brightness or low contrast, with an easy configuration the place made into the purpose, and offering the automatic-focusing adjustment of an electronic camera with a high precision at high speed.

[0020]

[Means for Solving the Problem] (Configuration) In order to solve the above-mentioned technical problem, this invention has adopted the following configurations.

[0021] Namely, a taking lens for this invention to carry out image formation of the photographic subject image in an automatic-focusing adjustment of an electronic camera, An image sensor for changing into a picture signal a photographic subject image by which image formation was carried out with said taking lens, An active triangular ranging means to project light on a photographic subject and to measure the target photographic subject distance, A focus means by contrast method which performs a focus using a high frequency component of an output signal in predetermined area of said image sensor, After driving said taking lens in a location of a specified quantity front focus or rear focusing to a focus location measured by said active triangular ranging means It is characterized by having a taking-lens drive control means which drives said taking lens based on a focus means by said contrast method, and performs a focus.

[0022] Moreover, a taking lens for this invention to carry out image formation of the photographic subject image in an automatic-focusing adjustment of an electronic camera, An image sensor for changing into a picture signal a photographic subject image by which image formation was carried out with said taking lens, A photographic subject brightness detection means to detect brightness of a photographic subject, and an active triangular ranging means to project light on a photographic subject and to measure the target photographic subject distance, A focus means by contrast method which performs a focus using a high frequency component of an output signal in predetermined area of said image sensor, When it judges that brightness of a photographic subject is high brightness more than predetermined with said photographic subject brightness detection means After driving said taking lens in a location of a specified quantity front focus or rear focusing to a focus location based on a ranging output of said active triangular ranging means When it judges that said taking lens is driven based on a focus means by said contrast method, a focus is performed, and photographic subject brightness is low brightness below a predetermined value It is characterized by having a taking-lens drive control means which drives said taking lens in a focus location based on a ranging output of said active triangular ranging means, and performs a focus.

[0023] Here, the following are raised as a desirable embodiment of this invention.

[0024] (1) A photographic subject brightness detection means should detect brightness of a photographic subject based on an output signal of an image sensor.

[0025] (2) An amount of a front focus or rear focusing should be an amount depending on a focal distance or a drawing value of a taking lens at the time of photography.

[0026] (3) In one ranging actuation, an active triangular ranging means projects a multiple-times infrared beam on a photographic subject, and measures photographic subject distance based on a composite signal acquired as a result of projection of multiple times.

[0027] (4) A taking-lens drive control means drives a taking lens at the 2nd speed later than the 1st speed based on a focus means by contrast method, after driving a taking lens at the 1st drive speed based on a ranging output of an active triangular ranging means.

[0028] (5) An active triangular ranging means should measure photographic subject distance based on an output signal of two photo detectors arranged on both sides of an optical projection area.

[0029] (6) An active triangular ranging means is having had an optical delivery system for short

distances which projects light on a photographic subject corresponding to an image in predetermined area of an image sensor when there is a photographic subject at a short distance, and an optical delivery system for long distances which projects light on a photographic subject corresponding to an image in predetermined area of an image sensor when a photographic subject's is in a long distance.

[0030] (Operation) According to this invention, since a contrast method and an active triangular ranging method are used together, a focus of high degree of accuracy can be performed at high speed. And since a sensor used for a contrast method makes an image sensor of an electronic camera serve a double purpose, a configuration becomes easy.

[0031] Moreover, after driving not to a focus location (the 1st location) by active triangular ranging means but to this focus location in a location (the 2nd location) of a specified quantity front focus or rear focusing, in order to drive a taking lens based on a focus means by contrast method and to perform a focus, focus actuation by contrast method can be performed quickly, and it becomes possible to perform a focus at a high speed more.

[0032] Moreover, automatic-focusing accommodation of a high speed and high degree of accuracy is attained, preventing a fall of precision of automatic-focusing accommodation by contrast method under low brightness, since a taking lens is driven in a focus location (the 1st location) based on a ranging output of an active triangular ranging means and a focus is performed, when photographic subject brightness judges it as low brightness below a predetermined value.

[0033] Moreover, by carrying out an adjustable setup of the amount of a front focus which sets a taking lens, or rear focusing according to a focal distance or a drawing value of a taking lens at the time of photography before focus actuation by contrast method, the amount of dotage at the time of focus actuation initiation by contrast method can become always the same, and it becomes possible to lessen useless migration more and to perform mountain-climbing AF more quickly.

[0034]

[Embodiment of the Invention] Hereafter, the operation gestalt of illustration of the details of this invention explains.

[0035] (1st operation gestalt) Drawing 1 is drawing showing the important section configuration of the electronic camera concerning the 1st operation gestalt of this invention.

[0036] 11 in drawing is a taking lens and this taking lens 11 is lens 11for focuses a, and lens 11for zoom b. It consists of lens 11c etc. The solid state image sensor with which 12 extracts and 13 consists of CCD etc. (it outlines Following CCD), A lens driving means for 14 to drive lens 11a for focuses, A zoom driving means for 15 to drive lens 11b for zoom and 16 A throttling control means, A digital process circuit for 20 to perform various image processings from the output signal (picture signal) of CCD13, A ranging means for 30 to measure the distance to a photographic subject with an active triangular ranging method, A stroboscope luminescence means for a system controller for 41 to control each part and 42 to emit light in a stroboscope, A liquid crystal display (LCD) for a flash plate MACHIKKU control means for 43 to control stroboscope luminescence and 44 to display the information on a photography image or others and 45 show the memory card for memorizing image data.

[0037] Drawing 2 is drawing for explaining the concrete configuration of the focus device in this operation gestalt, and its principle of operation. The ranging means 30 consists of infrared rays LED 31, the location sensing element (PSD) 32, a floodlighting lens 34, a light-receiving lens 35, and an active triangular ranging control circuit 38. With this ranging means 30, the light emitted from infrared rays LED 31 is irradiated through the floodlighting lens 34 at a photographic subject 50, and the floodlighting spot image 51 is formed on a photographic subject 50. This floodlighting spot image 51 is led to PSD42 through the light-receiving lens 35, the light-receiving spot image 52 is formed on PSD32, and PSD32 detects the location of the light-receiving spot image 52. And based on the detecting signal of PSD32, the distance to a photographic subject 50 is measured by the active triangular ranging control circuit 38.

[0038] What is necessary is here, to project a multiple-times infrared beam on a photographic subject 50, and just to measure photographic subject distance based on the composite signal acquired as a result of projection of multiple times in one ranging actuation, in order to raise the accuracy of measurement more. Since a noise is offset while the total amount of signals increases by projecting

multiple times, improvement in S/N can be aimed at.
[0039] The ranging signal by the ranging means 30 is supplied to a system controller 41, and the lens driving means 14 is controlled by the directions from this system controller 41 based on a ranging signal. And lens 11a for focuses is moved to the location according to a ranging signal by this lens driving means 14. 53 in drawing is a focus location by active triangular ranging.
[0040] The image pick-up output of CCD13 is supplied to the digital process circuit 20. In this digital process circuit 20, while performing various kinds of image processings to an image pick-up output, focus actuation by the contrast method is performed. That is, moving a lens location by predetermined within the limits, RF component of the image pick-up output in each location is detected, and lens 11a for focuses is moved by the lens driving means 14 so that RF component may serve as max (contrast peak). In the focus location according [54 in drawing] to a mountain-climbing method, and 55, infinity photographic subject focus location and 56 show a contrast curve, and 57 shows the contrast peak, respectively.
[0041] Moreover, the image pick-up output of CCD13 is supplied to the contrast detection means 21 and the brightness detection means 22. And a treatment process is changed according to the contrast and the brightness which were detected.
[0042] Next, the focus actuation and stroboscope control action in this operation gestalt are explained.
[0043] Drawing 3 is a flow chart which shows the focus actuation in this operation gestalt. First, if release of the camera is carried out, active triangular ranging will be performed by the ranging means 30 shown in said drawing 2 (S1). And based on ranging data, lens 11a for focuses drives by the lens driving means 14, and lens 11a is set to the focus location (the 1st location) 53 by active triangular ranging (S2).
[0044] Subsequently, photographic subject brightness is detected by the brightness detection means 22 based on the image pick-up output of CCD13, and the detected photographic subject brightness is higher than predetermined brightness, is low, or (low brightness) is judged (S3). When judged with high brightness, mountain-climbing AF by the contrast method is performed by centering on 1st location 53 shown by active triangular ranging predetermined within the limits (S4). Contrast is sequential-migration-detected for lens 11a for focuses from an image pick-up output on each point to a total of six points centering on the 1st location 53 approximately, and, specifically, lens 11a is moved to the location where contrast serves as a peak. Thereby, as shown in drawing 2 , a positioning setup of the lens 11a is carried out in the location 54 used as the contrast peak 57 of the contrast curve 56. What is necessary is here, just to set it as the several times as many range as the amount of permission defocusing of a taking lens 11 as a predetermined range in mountain-climbing AF.
[0045] subsequently -- or the contrast of contrast which the contrast of a photographic subject was detected by the contrast detection means 21, and was detected based on the image pick-up output of CCD13 is higher than a predetermined value -- (O.K.) -- it is low or (NG) is judged (S5). When judged with O.K., it moves to photography actuation (S6).
[0046] When judged with low brightness in the brightness judging of S3, or when it is judged with NG in the contrast judging of S5, based on active triangular ranging data, lens 11a drives in the focus location (the 1st location) 53 like S2. Then, it will move to photography actuation of S6. That is, a focus will be performed by only the active triangular ranging method when the focus by the contrast method does not work.
[0047] On the other hand, flash plate MACHIKKU control which controls the amount of luminescence by this operation gestalt according to the distance to a photographic subject in control of a stroboscope is performed. Flash plate MACHIKKU control changes the amount of luminescence of a stroboscope according to the distance to a photographic subject, and the stroboscope luminescence means 42 and the flash plate MACHIKKU control means 43 perform it as follows. That is, based on the distance signal acquired by the ranging means 30, adjustable [of the amount of luminescence of the stroboscope luminescence means 42] is carried out by the flash plate MACHIKKU control means 43, and the amount of the light irradiated by the photographic subject is controlled the optimal. In this case, without acting on depth of field, flash plate MACHIKKU control with a high precision can be performed, and it is suitable for the deep electronic camera of depth of

field.
[0048] Although it is also possible to perform flash plate MACHIKKU control using a contrast method here, it is more desirable to use a triangular ranging method as mentioned above. Since the focus by the contrast method does not measure the distance to a photographic subject directly, in order to specify distance using a contrast method, after focusing, a certain data processing is needed. It is disadvantageous all the more in respect of speed because the contrast method needs data processing for the speed to a focus to be slow and use for flash plate MACHIKKU control further as compared with a triangular ranging method. Moreover, especially by the contrast method, since the depth of focus becomes deep at a wide angle side, although the focus of a lens suits, the situation where an exact distance cannot be specified produces it. On the other hand, a triangular ranging method is direct distance detection, and since detection speed is also still quicker, it can carry out flash plate MACHIKKU control to a high speed and high degree of accuracy by using this.
[0049] Moreover, it is a wide angle and looking-far side, and it is also possible to choose and use a triangular ranging method and a contrast method. As explained previously, when a taking lens 11 is set to a wide angle side rather than a predetermined value, flash plate MACHIKKU control of high degree of accuracy can be performed by performing flash plate MACHIKKU control of the stroboscope luminescence means 42 based on the distance signal acquired by the triangular ranging means 30, without being influenced by depth of field.
[0050] However, when a taking lens 11 is set to a looking-far side, if the triangular ranging means 30 is used, the amount of luminescence is insufficient and precision may be unable to be maintained. Then, when set to a looking-far side, based on the distance signal acquired based on the focus means by the contrast method, flash plate MACHIKKU control of the stroboscope luminescence means 42 is performed. Thereby, the flash plate MACHIKKU control with a high precision is attained at a looking-far side at a wide angle side.
[0051] In addition, although the amount of luminescence of a stroboscope may be controlled as flash plate MACHIKKU control according to the distance to a photographic subject as described above, you may make it instead control drawing of a taking lens according to the distance to a photographic subject. Furthermore, you may make it control these both.
[0052] Thus, according to this operation gestalt, focusing can be carried out to high degree of accuracy at high speed by using together an active triangular ranging method and a contrast method. By the active triangular ranging method, although it can focus at high speed, it cannot say that precision is enough, but on the other hand, with a contrast method, although it can focus to high degree of accuracy, it takes time amount. Then, focusing of a high speed and high degree of accuracy can be performed by using these two methods together, and an active triangular ranging method's performing coarse alignment, and performing accurate alignment with a contrast method.
[0053] Moreover, with this operation gestalt, in order to perform the focus by the contrast method from the image pick-up output of CCD13 for an image pick-up, it is not necessary to newly form an image sensor, and simplification of a configuration can be attained. Furthermore, in the ranging means 30, it becomes possible to carry out active triangular ranging to high degree of accuracy more by projecting a multiple-times infrared beam on a photographic subject, and measuring photographic subject distance based on the composite signal acquired as a result of projection of multiple times in one ranging actuation.
[0054] Moreover, based on the distance signal by the ranging means, by performing flash plate MACHIKKU control based on the distance signal by the contrast method, a wide angle side is crossed to all the ranges from a wide angle side to a looking-far side, and the flash plate MACHIKKU control of it with a high precision is attained by the looking-far side.
[0055] (2nd operation gestalt) Drawing 4 is drawing for explaining the concrete configuration of the focus device in the electronic camera concerning the 2nd operation gestalt of this invention, and its principle of operation. In addition, the same sign is given to the same portion as drawing 2, and the detailed explanation is omitted.
[0056] The point that this operation gestalt differs from the 1st previous operation gestalt arranges the light sensing portion in the ranging means 30 on both sides of the floodlighting section, and is to have constituted the so-called both eyes AF. That is, in the ranging means 30, PSD(s) 32a and 32b are arranged in the symmetric position of the both sides of pair Perilla frutescens (L.) Britton var.

crispa (Thunb.) Decne. at LED31, respectively, and the light-receiving lenses 35a and 35b are arranged to each PSD(s) 32a and 32b, respectively.
[0057] With the ranging means 30 of this operation gestalt, the light emitted from LED31 is irradiated by the photographic subject 50 through the floodlighting lens 34, and the floodlighting spot image 51 is formed on a photographic subject 50. This floodlighting spot image 51 is led by light-receiving lens 35a on PSD32a, light-receiving spot image 52a is formed, and that location is detected by PSD32a. The spot image 51 is led by light-receiving lens 35b on PSD32b, light-receiving spot image 52b is formed in coincidence, and the location is detected by PSD32b. And in the active triangular ranging control circuit 38, the distance to a photographic subject 50 is measured by equalizing each detection output of two PSD(s) 32a and 32b.
[0058] Drawing 5 (a) and (b) are the perspective diagrams showing the configuration of the focus device in this operation gestalt. LED31 and PSD(s) 32a and 32b are formed in the AF substrate 61 at one, and are attached in the case 62 equipped with the floodlighting lens 34 and the light-receiving lenses 35a and 35b. And it is arranged on the outside of the lens system for photography.
[0059] Moreover, in this example, the light 65 to which the pattern was attached is irradiated through the floodlighting lens 66 as a cure against the Rochon trust at a photographic subject, and the photographic subject image 67 at that time is picturized by CCD13. In this case, also when the contrast in a photographic subject is low, the focus by the contrast method is attained. As a means to irradiate the light to which the pattern was attached, it is (1). A pattern is formed in the LED itself.
(2) Arrange a grid pattern all over LED.
(3) Form a grid pattern in the lens itself.
****** may be adopted.
[0060] Here, if a spot chip arises in the light-receiving spot image 52 as shown in drawing 6 when the ranging means 30 as shown in said drawing 2 is used, measurement by the ranging means 30 will be out of order. If lens 11a is driven based on this mistaken measurement result and the focus by the contrast method is performed, in the successive range of lens 11a by the contrast method, a contrast peak will not be acquired but the situation which cannot perform an exact focus will arise.
[0061] On the other hand, with this operation gestalt, since PSD32 is arranged on both sides of LED31, the effect of a spot chip can be offset, and even if there is a spot chip, accurate ranging can be performed. Moreover, since the quantity of light doubles, improvement in S/N can also be aimed at.
[0062] (3rd operation gestalt) Drawing 7 is drawing showing the basic configuration of the active triangular ranging section in the electronic camera concerning the 3rd operation gestalt of this invention.
[0063] In active triangular ranging, the movement magnitude of the light-receiving spot location by change of a photographic subject location increases, so that the installation location of PSD is far from the lens shaft for photography to radial (sensitivity becomes high), and the movement magnitude of the light-receiving spot location by change of a photographic subject location decreases, so that it is near (sensitivity becomes low). It it arranges PSD in the location near a lens shaft, although measurement of a short distance is possible, sufficient sensitivity is not obtained to a long distance, but the measurement becomes impossible [measurement]. Although sensitivity sufficient also by long-distance measurement will be obtained if PSD is arranged in a location distant from a lens shaft, at close range, as for the movement magnitude of past [the high one] and spot light, reverse has [of stopping to be unable to cover by PSD] too much sensitivity.
[0064] On the other hand, with this operation gestalt, as shown in drawing 7 (a), system of measurement which is different with a short distance and a long distance, respectively is used. When a photographic subject location is near, the light which came out of LED31a on the left-hand side of drawing 7 (a) is irradiated at a photographic subject, the reflected light is detected by PSD32a, the light which came out of LED31b on the right-hand side of drawing 7 (a) when a photographic subject location was far is irradiated at a photographic subject, and the reflected light is detected by PSD32b. Thereby, highly sensitive measurement is attained irrespective of a photographic subject location.
[0065] Moreover, as shown in drawing 7 (b), by devising the arrangement location of LED 31a and 31b and PSD32, PSD32 can be set to one and the light-receiving lens 35 can be shared by two

system of measurement.
[0066] (4th operation gestalt) Drawing 8 is a flow chart which shows focus actuation of the electronic camera concerning the 4th operation gestalt of this invention.
[0067] With this operation gestalt, although the configuration of an electronic camera and a focusing device is the same as that of the 1st operation gestalt, the lens migration locations in the coarse control by the ranging means differ. That is, speeding up of the focus actuation by the contrast method is attained by making it move to the location of a front focus or rear focusing rather than making it move to a focus location by active triangular ranging.
[0068] With this operation gestalt, if release of the electronic camera is carried out first, active triangular ranging will be performed like the 1st operation gestalt (drawing 2) (S1). Subsequently, photographic subject brightness is detected by the brightness detection means 22 based on the image pick-up output of CCD13, and the detected photographic subject brightness is higher than predetermined brightness, is low, or (low brightness) is judged (S2). When judged with high brightness, based on ranging data, lens 11a for focuses drives by the lens driving means 14, and lens 11a is set to the 2nd different location from a focus location (the 1st location) (S3). This 2nd location is a location of a front focus or rear focusing more slightly than the 1st location.
[0069] Subsequently, mountain-climbing AF by the contrast method is performed by moving lens 11a by making into the starting point the 2nd location obtained by the active triangular ranging means 22 (S4). Here, lens 11a can be promptly set as a contrast peak location by moving lens 11a in the direction of CCD to the focus location of active triangular ranging, if it is a front focus, and it is rear focusing in the direction of a photographic subject about lens 11a. That is, the migration direction of the beginning of lens 11a can be set to the side which a focus suits, processing until it finds a contrast peak can be simplified, and focus actuation can be performed quickly.
[0070] Although contrast may become low by migration of the first lens 11a when lens 11a is set to a focus location with a ranging signal, the migration direction of lens 11a must be made into reverse in this case. On the other hand, since contrast always becomes high by migration of the beginning of lens 11a like this operation gestalt by setting lens 11a to the location of a front focus or rear focusing with a ranging signal, useless migration can be lost and mountain-climbing AF can be performed quickly.
[0071] Moreover, as for the amount of a front focus or rear focusing, it is desirable to set it as the degree to which a photographic subject image fades slightly, and the degree which the rise of contrast can specifically distinguish certainly by the first migration in near and mountain-climbing AF which follows in a focus location comparatively. Since the amount of dotage by the front focus or rear focusing changes with the focal distance and lens drawing value of a taking lens, when the amount of a front focus or rear focusing is similarly set up, the amount of dotage at the time of the focus actuation initiation by the contrast method will change by the focal distance and lens drawing value change of a taking lens. Therefore, it is desirable to carry out an adjustable setup of the amount of a front focus or rear focusing according to the focal distance and lens drawing value of a taking lens so that the amount of dotage at the time of the focus actuation initiation by the contrast method may become always the same. In this case, it becomes possible to lessen useless migration more and to perform mountain-climbing AF more quickly.
[0072] subsequently -- or the contrast which the contrast of a photographic subject was detected by the contrast detection means 21, and was detected based on the image pick-up output of CCD13 is higher than a predetermined value -- (O.K.) -- it is low or (NG) is judged (S5). When judged with O.K., it moves to photography actuation (S6).
[0073] When judged with low brightness in the brightness judging of S2, or when it is judged with NG in the contrast judging of S5, lens 11a drives in the 1st location which is a focus location based on active triangular ranging data. Then, it will move to photography actuation of S6. That is, a focus will be performed by only the active triangular ranging method when the focus by the contrast method does not work.
[0074] Thus, with this operation gestalt, since it is made to perform focus actuation by the contrast method after moving lens 11a for focuses to the location of not the focus location by active triangular ranging but a front focus, or rear focusing, it becomes possible to perform focus actuation by the contrast method quickly, and high-speed focusing becomes more possible.

[0075] (5th operation gestalt) Drawing 9 is a flow chart which shows the automatic-focusing control action of the electronic camera concerning the 5th operation gestalt of this invention.
[0076] With this operation gestalt, although the configuration of an electronic camera and a focusing device is the same as that of the 1st operation gestalt, the lens passing speed in two steps of focuses is changed. That is, when making it move to a focus location by active triangular ranging, lens passing speed is made quick, and when making it move to the focus location by the contrast method, lens passing speed is made late.
[0077] First, if release of the camera is carried out, active triangular ranging will be performed like the 1st operation gestalt (drawing 2) (S1). And based on ranging data, lens 11a for focuses drives with the 1st passing speed V1 by the lens driving means 14, and lens 11a is set to the focus location (the 1st location) 53 (S2).
[0078] Subsequently, like the 1st operation gestalt, photographic subject brightness is detected by the brightness detection means 22 based on the image pick-up output of CCD13, and the detected photographic subject brightness is higher than predetermined brightness, is low, or (low brightness) is judged (S3). When judged with high brightness, mountain-climbing AF by the contrast method is performed by centering on 1st location 53 shown by active triangular ranging predetermined within the limits (S4). At this time, lens 11a is moved with the 2nd passing speed V2 (V2<V1) later than the 1st passing speed V1. Thereby, lens 11a is set to the location used as a contrast peak, i.e., a focus location.
[0079] subsequently -- or the contrast of contrast which the contrast of a photographic subject was detected by the contrast detection means 21, and was detected based on the image pick-up output of CCD13 is higher than a predetermined value -- (O.K.) -- it is low or (NG) is judged (S5). When judged with O.K., it moves to photography actuation (S6).
[0080] When judged with low brightness in the brightness judging of S3, or when it is judged with NG in the contrast judging of S5, like S2, based on active triangular ranging data, lens 11a drives with the 1st passing speed V1, and is set as the focus location (the 1st location) 53. Then, it will move to photography actuation of S6.
[0081] Thus, with this operation gestalt, by making lens passing speed quick, much more improvement in the speed can be timed, and much more high-degree-of-accuracy-ization can be achieved by making lens passing speed late by the fine control by the contrast method by the coarse control by active triangular ranging.
[0082] (6th operation gestalt) Drawing 10 is a flow chart which shows focusing actuation of the electronic camera concerning the 6th operation gestalt of this invention.
[0083] With this operation gestalt, although the configuration of an electronic camera and a focusing device is the same as that of the 1st operation gestalt, the lens migration locations in the coarse control by the ranging means differ, and the lens passing speed in two more steps of focuses is changed. That is, the 4th operation gestalt and the 5th operation gestalt are combined.
[0084] First, if release of the electronic camera is carried out, active triangular ranging will be performed like the 1st operation gestalt (drawing 2) (S1). Subsequently, photographic subject brightness is detected by the brightness detection means 22 based on the image pick-up output of CCD13, and the detected photographic subject brightness is higher than predetermined brightness, is low, or (low brightness) is judged (S2). When judged with high brightness, based on ranging data, lens 11a for focuses drives at the 1st drive speed V1 by the lens driving means 14, and lens 11a is set to the 2nd different location from the focus location (the 1st location) by triangular ranging (S3). This 2nd location is a location of a front focus or rear focusing more slightly than the 1st location.
[0085] Subsequently, mountain-climbing AF by the contrast method is performed by moving lens 11a by making into the starting point the 1st location shown by active triangular ranging (S4). At this time, lens 11a is moved with the 2nd passing speed V2 (V2<V1) later than the 1st passing speed V1.
[0086] Here, to the focus location by active triangular ranging, if it is a front focus, and it is rear focusing in the direction of a photographic subject about lens 11a, lens 11a can be promptly set as a contrast peak location by moving lens 11a in the direction of CCD. That is, the migration direction of the beginning of lens 11a can be set to the side which a focus suits, processing until it finds a contrast peak can be simplified, and focus actuation can be performed quickly.
[0087] subsequently -- or the contrast of contrast which the contrast of a photographic subject was

detected by the contrast detection means 21, and was detected based on the image pick-up output of CCD13 is higher than a predetermined value -- (O.K.) -- it is low or (NG) is judged (S5). When judged with O.K., it moves to photography actuation (S6).
[0088] When judged with low brightness in the brightness judging of S2, or when it is judged with NG in the contrast judging of S5, based on active triangular ranging data, lens 11a drives with the 1st passing speed V1, and is set as the 1st location which is a focus location by triangular ranging. Then, it will move to photography actuation of S6. That is, a focus will be performed by only the active triangular ranging method when the focus by the contrast method does not work.
[0089] Thus, with this operation gestalt, since it is made to perform focus actuation by the contrast method like the 4th operation gestalt after moving lens 11a for focuses to the location of not the focus location by active triangular ranging but a front focus, or rear focusing, it becomes possible to perform focus actuation by the contrast method quickly, and high-speed focusing becomes more possible. Moreover, like the 5th operation gestalt, by making lens passing speed quick, much more improvement in the speed can be timed, and much more high-degree-of-accuracy-ization can be achieved by making lens passing speed late by the fine control by the contrast method by the coarse control by active triangular ranging.
[0090] (7th operation gestalt) Drawing 11 is drawing showing the important section configuration of the electronic camera concerning the 7th operation gestalt of this invention. In addition, the same sign is given to the same portion as the 1st operation gestalt (drawing 1), and the detailed explanation is omitted.
[0091] The point that this operation gestalt differs from the 1st operation gestalt forms the factice CPU 70 who has means of communications 71, and is to have enabled actuation of the ranging means 30 independently.
[0092] Drawing 12 is a flow chart which shows the focus actuation in this operation gestalt.
[0093] First, it is confirmed by check period 10msec whether the touch sensor attached to the release carbon button of a camera turned on (S1). Electric power will be supplied by cameras (CCD etc.) if having been touched is detected. And a photometry is performed (S2) and WB (white balance) is adjusted further (S3).
[0094] Subsequently, if 1st release (the shutter switch is two steps and the case where the case where it pushes shallowly is pushed to 1st release and the last will be called 2nd release) serves as ON, active triangular ranging will be performed (S5). This active triangular ranging compounds and equalizes the detection data based on 16 floodlighting.
[0095] Subsequently, based on a triangular ranging output, lens 11a is moved to this side (front focus) of a focus location (S6). Then, with a contrast method, the peak of contrast is detected in six frames and lens 11a is moved to a peak location (S7). And it judges whether peak detection succeeded (S8).
[0096] Here, in parallel to the lens migration based on the above-mentioned triangular ranging output, and the focus actuation by the contrast method, active triangular ranging for the second time is performed. In this active triangular ranging, since the focus actuation by the contrast method is slow, ranging by floodlighting is performed 3 times 16 times, ranging and 4 times in all of the ranging data based on S5 are integrated, distance is calculated from an addition output, and the distance to a photographic subject is measured (S9). Since this parallel processing has formed the factice CPU 70 as shown in said drawings 11, it becomes possible.
[0097] When the peak detection in S8 is NG, lens 11a is driven based on the ranging data in S9 (S10). That is, when the focus by the contrast method does not work, it will focus based on 4 times of the ranging data (64 times floodlighting data) based on triangular ranging. Moreover, when the peak detection in S8 is O.K., after performing focus actuation by S10 further, the flash plate MACHIKKU operation by floodlighting data is performed 64 times (S11). Thereby, according to the distance to a photographic subject, the amount of luminescence of a stroboscope is controlled the optimal.
[0098] And while 1st release has been in ON condition, when (S12) and also 2nd release also serve as ON, (S13) and photography are started (S14). In S12, if 1st release serves as OFF, it will return to a start. When 1st release is [2nd release] OFF in ON, it waits until 2nd release turns on.
[0099] Thus, according to this operation gestalt, focusing can be carried out to high degree of

accuracy at high speed by using together an active triangular ranging method and a contrast method like the 1st operation gestalt. Furthermore, in order to perform the focus by the contrast method from the image pick-up output of CCD13 for an image pick-up, it is not necessary to newly form an image sensor, and simplification of a configuration can be attained.

[0100] Since the output signal acquired by triangular ranging (a total of 4 times of ranging by 16 times floodlighting) of multiple times is integrated with this operation gestalt in addition to these, based on the good output signal of S/N, the distance signal of high degree of accuracy can be acquired, and flash plate MACHIKKU control with a high precision can be performed. Moreover, since focus actuation will be performed based on the distance signal of the high degree of accuracy acquired by triangular ranging of multiple times when the focus by the contrast method does not work, focusing can be carried out to high degree of accuracy rather than the case where it is based on 1 time of triangular ranging. Moreover, since the infrared beam of multiple times is irradiated at a photographic subject and active triangular ranging is performed while driving the lens based on the focus means by the contrast method, there is also no un-arranging -- the whole ranging time amount becomes long.

[0101] In addition, this invention is not limited to each operation gestalt mentioned above, it is the range which does not deviate from the summary, and can deform variously and can be carried out.

[0102]

[Effect of the Invention] As explained in full detail above, according to this invention, a focus can be carried out to high degree of accuracy at high speed by using together a contrast method and a triangular ranging active ranging method, and performing focus actuation of a taking lens. And since the image sensor of an electronic camera is used also [sensor / which is used for a contrast method], the configuration for a focus becomes easy.

[0103] Moreover, after driving not to the focus location (the 1st location) by the active triangular ranging means but to this focus location in the location (the 2nd location) of a specified quantity front focus or rear focusing, in order to drive a taking lens based on the focus means by the contrast method and to perform a focus, focus actuation by the contrast method can be performed quickly, and it becomes possible to perform a focus at a high speed more.

[0104] Moreover, automatic-focusing accommodation of a high speed and high degree of accuracy is attained, preventing the fall of the precision of the automatic-focusing accommodation by the contrast method under low brightness, since a taking lens is driven in a focus location (the 1st location) based on the ranging output of an active triangular ranging means and a focus is performed, when photographic subject brightness judges it as the low brightness below a predetermined value.

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] Especially this invention relates to the automatic-focusing adjustment of the electronic camera equipped with the image sensor with respect to an automatic-focusing adjustment.
[0002]

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PRIOR ART

[Description of the Prior Art] Conventionally, the image data of the area of the predetermined portion on the image sensor (on behalf of an image sensor, hereafter referred to as "CCD") with which image formation of the photographic subject image by which incidence is carried out through a taking lens as an automatic-focusing adjustment of an electronic camera is carried out is read for every predetermined drive unit of a lens, and the so-called mountain-climbing method (one of the contrast methods) of driving a lens is adopted as the location where the contrast becomes the maximum.

[0003] However, this method has some following troubles.

[0004] ** At the time of low brightness, focus time amount becomes extremely long. From the principle of a mountain-climbing method, unless pinpointing of a photographic subject location is after scanning all lens drive ranges, it is impossible. And 1 time per predetermined drive unit of a lens of the CCD reset time is required, and there was a problem of becoming such extremely long time amount that focus time amount exceeding 1 second, at the time of the low brightness to which the CCD reset time becomes longer than 1/15 second. Furthermore, since CCD sensitivity falls so that the number of pixels generally increases, in the electronic camera which pursues photograph image quality, the above-mentioned problem appears [to which the CCD reset time is becoming long steadily] notably.

[0005] ** When contrast was low, the peak of contrast was not caught, but it became focus impossible, and there was a problem of spoiling the feeling of actuation of a camera remarkably.

[0006] ** Compared with the film-based camera, on relation with a small area of an image pick-up side, since the focal distance of a taking lens was short, depth of field of the electronic camera were very deep, and it had the problem that photographic subject distance with available precision level effective in flash plate MACHIKKU was undetectable, by the mountain-climbing method. This problem appears so notably that the focal distance of a taking lens is on a wide side.

[0007] In order to solve the problem of the focus time amount of the above-mentioned **, AF sensor is arranged near the schedule focal plane where image formation of the photographic subject image is carried out, and in the order location, and the method which detects the amount of defocusing and its direction from the contrast difference of each AF sensor, and performs a lens drive is opened to JP,55-155308,A. However, this is the technology in the film-based camera which can tune up electrical characteristics and the optical layout of CCD only to AF sensors, and an image pick-up element element cannot apply it to the electronic camera which is making CCD as an AF sensor serve a double purpose.

[0008] AF method with which the classes of a contrast method and phase contrast method differ is used together in JP,7-43605,A, a phase contrast method performs coarse control to it, a contrast method performs fine control to it, and the technique to which focus actuation is carried out is opened to it. However, the automatic focusing device indicated by this official report needs to be specially equipped with the area sensor for a contrast method other than AF equipment of a phase contrast method on the assumption that a film-based camera, and cost becomes high while equipment is enlarged. Moreover, the congruence method put together here cannot solve the low contrast problem of **.

[0009] Moreover, neither the case where an object exists far away, nor quantity of light bright [in the perimeter] and sufficient, at the time of low contrast is obtained, and this is ineffective [in order to solve the problem of focus time amount and the low contrast problem of ** in the low brightness of **, the active method with which a fill-in flash is floodlighted and the weak spot of a passive method is compensated is well-known, but], if an object is not a short distance comparatively.

[0010] In order to raise the effect of an active method, when fill-in flash reinforcement is raised, the power consumption for floodlighting becomes immense and free is a problem at an electronic camera to be reduced [of power consumption]. (From the first, by the mountain-climbing method, fill-in flash floodlighting must be theoretically continued among lens drive time amount, and, unlike a film-based camera, the power consumption cannot be disregarded with an electronic camera.) It is necessary to put the spectrum of a fill-in flash into a visible region for image sensor combination, and mischievous optical power-up gives [the person taken a photograph] pain, such as being dazzling, and is not desirable again.

[0011] Moreover, there is technique of pinpointing the bottom of combination and the unique condition of each method in order to compensate the weak spot of two methods where an active method differs from a passive method, as one of the technique of solving the above-mentioned problem, and using it alternatively as described at JP,9-325262,A. However, unlike a film-based camera, an electronic camera is the following called focus equipment of image sensor combination. (1) - (4) A restriction peculiar to an electronic camera [like] exists.

[0012] (1) Since there is a problem of image quality, the sensitivity rise of an image sensor cannot be performed simply.

(2) Since there is a problem of image resolution, an optimal setup of the magnitude which is a pixel cannot be carried out for AF.

(3) A spectral region cannot be optimized because of a RGB filter and an infrared cut-off filter.

(4) Since full-screen read-out is required, the optimum design of the image sensor read-out speed cannot be carried out to AF.

[0013] For this reason, it is difficult to optimize an image sensor as the distance measuring equipment thru/or focus equipment of a passive mold also optically and electrically including a layout like a film-based camera, and an extensive improvement of focus equipment cannot be desired only by the technique only alternatively used like the conventional technology.

[0014] In the method which performs coarse control with an active triangular ranging method, and performs fine control with a contrast method on the other hand, when it was incompletely projected on light by the photographic subject in the active triangular ranging method, there was fault which outputs extreme short-distance data and long distance data, for this reason there was a problem which the situation where the peak of contrast does not exist generates in lens drive within the limits of the predetermined range based on the ranging output of an active triangular ranging method.

[0015] Furthermore, the so-called parallax from which the projection location of the light by the active triangular ranging method and the location of the focal detection area of CCD by the contrast method differ with photographic subject distance arose, and there was a problem that the situation where a contrast peak cannot be caught occurred.

[0016] Moreover, when incompletely projected on the case where it is incompletely projected on an infrared beam on left-hand side to a photographic subject, and right-hand side (set for the photographic subject of far and near coexistence) Since the photographic subject distance which happens when projected on light near [the] a boundary and which completely shifted to the so-called problem of a spot chip to hard flow was outputted , when a taking lens was driven in the predetermined range based on a contrast method after the focus by the active triangular ranging method , the peak location of contrast could not be pinpointed but there was a problem that focus time amount became long on the contrary .

[0017] Although what is necessary is just to take the large width of face of the above-mentioned predetermined range with allowance as a cure in such a case in order to catch the peak of contrast certainly, it will be contradictory to take this large for the purpose of shortening original focus time amount.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained in full detail above, according to this invention, a focus can be carried out to high degree of accuracy at high speed by using together a contrast method and a triangular ranging active ranging method, and performing focus actuation of a taking lens. And since the image sensor of an electronic camera is used also [sensor / which is used for a contrast method], the configuration for a focus becomes easy.
[0103] Moreover, after driving not to the focus location (the 1st location) by the active triangular ranging means but to this focus location in the location (the 2nd location) of a specified quantity front focus or rear focusing, in order to drive a taking lens based on the focus means by the contrast method and to perform a focus, focus actuation by the contrast method can be performed quickly, and it becomes possible to perform a focus at a high speed more.
[0104] Moreover, automatic-focusing accommodation of a high speed and high degree of accuracy is attained, preventing the fall of the precision of the automatic-focusing accommodation by the contrast method under low brightness, since a taking lens is driven in a focus location (the 1st location) based on the ranging output of an active triangular ranging means and a focus is performed, when photographic subject brightness judges it as the low brightness below a predetermined value.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Thus, when the contrast method was conventionally adopted in the automatic-focusing adjustment of an electronic camera, the problem that precision was not securable for the bottom of the problem that a focus takes time amount, low brightness, or low contrast was caused.
[0019] It is in this invention having been made in consideration of the above-mentioned situation, and a focus taking time amount by the contrast method, solving the problem that precision is not securable for the bottom of low brightness or low contrast, with an easy configuration the place made into the purpose, and offering the automatic-focusing adjustment of an electronic camera with a high precision at high speed.

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MEANS

[Means for Solving the Problem] (Configuration) In order to solve the above-mentioned technical problem, this invention has adopted the following configurations.
[0021] That is, this invention is characterized by an automatic-focusing adjustment of an electronic camera possessing the following. A taking lens for carrying out image formation of the photographic subject image An image sensor for changing into a picture signal a photographic subject image by which image formation was carried out with said taking lens An active triangular ranging means to project light on a photographic subject and to measure the target photographic subject distance A taking-lens drive control means which drives said taking lens based on a focus means by contrast method which performs a focus using a high frequency component of an output signal in predetermined area of said image sensor, and a focus means according to said contrast method after driving said taking lens in a location of a specified quantity front focus or rear focusing to a focus location measured by said active triangular ranging means, and performs a focus
[0022] Moreover, this invention is characterized by an automatic-focusing adjustment of an electronic camera possessing the following. A taking lens for carrying out image formation of the photographic subject image An image sensor for changing into a picture signal a photographic subject image by which image formation was carried out with said taking lens A photographic subject brightness detection means to detect brightness of a photographic subject An active triangular ranging means to project light on a photographic subject and to measure the target photographic subject distance, A focus means by contrast method which performs a focus using a high frequency component of an output signal in predetermined area of said image sensor, When it judges that brightness of a photographic subject is high brightness more than predetermined with said photographic subject brightness detection means After driving said taking lens in a location of a specified quantity front focus or rear focusing to a focus location based on a ranging output of said active triangular ranging means When it judges that said taking lens is driven based on a focus means by said contrast method, a focus is performed, and photographic subject brightness is low brightness below a predetermined value A taking-lens drive control means which drives said taking lens in a focus location based on a ranging output of said active triangular ranging means, and performs a focus
[0023] Here, the following are raised as a desirable embodiment of this invention.
[0024] (1) A photographic subject brightness detection means should detect brightness of a photographic subject based on an output signal of an image sensor.
[0025] (2) An amount of a front focus or rear focusing should be an amount depending on a focal distance or a drawing value of a taking lens at the time of photography.
[0026] (3) In one ranging actuation, an active triangular ranging means projects a multiple-times infrared beam on a photographic subject, and measures photographic subject distance based on a composite signal acquired as a result of projection of multiple times.
[0027] (4) A taking-lens drive control means drives a taking lens at the 2nd speed later than the 1st speed based on a focus means by contrast method, after driving a taking lens at the 1st drive speed based on a ranging output of an active triangular ranging means.
[0028] (5) An active triangular ranging means should measure photographic subject distance based on an output signal of two photo detectors arranged on both sides of an optical projection area.
[0029] (6) An active triangular ranging means is having had an optical delivery system for short

distances which projects light on a photographic subject corresponding to an image in predetermined area of an image sensor when there is a photographic subject at a short distance, and an optical delivery system for long distances which projects light on a photographic subject corresponding to an image in predetermined area of an image sensor when a photographic subject's is in a long distance.

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OPERATION

(Operation) According to this invention, since a contrast method and an active triangular ranging method are used together, a focus of high degree of accuracy can be performed at high speed. And since a sensor used for a contrast method makes an image sensor of an electronic camera serve a double purpose, a configuration becomes easy.
[0031] Moreover, after driving not to a focus location (the 1st location) by active triangular ranging means but to this focus location in a location (the 2nd location) of a specified quantity front focus or rear focusing, in order to drive a taking lens based on a focus means by contrast method and to perform a focus, focus actuation by contrast method can be performed quickly, and it becomes possible to perform a focus at a high speed more.
[0032] Moreover, automatic-focusing accommodation of a high speed and high degree of accuracy is attained, preventing a fall of precision of automatic-focusing accommodation by contrast method under low brightness, since a taking lens is driven in a focus location (the 1st location) based on a ranging output of an active triangular ranging means and a focus is performed, when photographic subject brightness judges it as low brightness below a predetermined value.
[0033] Moreover, by carrying out an adjustable setup of the amount of a front focus which sets a taking lens, or rear focusing according to a focal distance or a drawing value of a taking lens at the time of photography before focus actuation by contrast method, the amount of dotage at the time of focus actuation initiation by contrast method can become always the same, and it becomes possible to lessen useless migration more and to perform mountain-climbing AF more quickly.
[0034]
[Embodiment of the Invention] Hereafter, the operation gestalt of illustration of the details of this invention explains.
[0035] (1st operation gestalt) Drawing 1 is drawing showing the important section configuration of the electronic camera concerning the 1st operation gestalt of this invention.
[0036] 11 in drawing is a taking lens and this taking lens 11 is lens 11for focuses a, and lens 11for zoom b. It consists of lens 11c etc. The solid state image sensor with which 12 extracts and 13 consists of CCD etc. (it outlines Following CCD), A lens driving means for 14 to drive lens 11a for focuses, A zoom driving means for 15 to drive lens 11b for zoom and 16 A throttling control means, A digital process circuit for 20 to perform various image processings from the output signal (picture signal) of CCD13, A ranging means for 30 to measure the distance to a photographic subject with an active triangular ranging method, A stroboscope luminescence means for a system controller for 41 to control each part and 42 to emit light in a stroboscope, A liquid crystal display (LCD) for a flash plate MACHIKKU control means for 43 to control stroboscope luminescence and 44 to display the information on a photography image or others and 45 show the memory card for memorizing image data.
[0037] Drawing 2 is drawing for explaining the concrete configuration of the focus device in this operation gestalt, and its principle of operation. The ranging means 30 consists of infrared rays LED 31, the location sensing element (PSD) 32, a floodlighting lens 34, a light-receiving lens 35, and an active triangular ranging control circuit 38. With this ranging means 30, the light emitted from infrared rays LED 31 is irradiated through the floodlighting lens 34 at a photographic subject 50, and the floodlighting spot image 51 is formed on a photographic subject 50. This floodlighting spot image 51 is led to PSD42 through the light-receiving lens 35, the light-receiving spot image 52 is

formed on PSD32, and PSD32 detects the location of the light-receiving spot image 52. And based on the detecting signal of PSD32, the distance to a photographic subject 50 is measured by the active triangular ranging control circuit 38.

[0038] What is necessary is here, to project a multiple-times infrared beam on a photographic subject 50, and just to measure photographic subject distance based on the composite signal acquired as a result of projection of multiple times in one ranging actuation, in order to raise the accuracy of measurement more. Since a noise is offset while the total amount of signals increases by projecting multiple times, improvement in S/N can be aimed at.

[0039] The ranging signal by the ranging means 30 is supplied to a system controller 41, and the lens driving means 14 is controlled by the directions from this system controller 41 based on a ranging signal. And lens 11a for focuses is moved to the location according to a ranging signal by this lens driving means 14. 53 in drawing is a focus location by active triangular ranging.

[0040] The image pick-up output of CCD13 is supplied to the digital process circuit 20. In this digital process circuit 20, while performing various kinds of image processings to an image pick-up output, focus actuation by the contrast method is performed. That is, moving a lens location by predetermined within the limits, RF component of the image pick-up output in each location is detected, and lens 11a for focuses is moved by the lens driving means 14 so that RF component may serve as max (contrast peak). In the focus location according [54 in drawing] to a mountain-climbing method, and 55, infinity photographic subject focus location and 56 show a contrast curve, and 57 shows the contrast peak, respectively.

[0041] Moreover, the image pick-up output of CCD13 is supplied to the contrast detection means 21 and the brightness detection means 22. And a treatment process is changed according to the contrast and the brightness which were detected.

[0042] Next, the focus actuation and stroboscope control action in this operation gestalt are explained.

[0043] Drawing 3 is a flow chart which shows the focus actuation in this operation gestalt. First, if release of the camera is carried out, active triangular ranging will be performed by the ranging means 30 shown in said drawing 2 (S1). And based on ranging data, lens 11a for focuses drives by the lens driving means 14, and lens 11a is set to the focus location (the 1st location) 53 by active triangular ranging (S2).

[0044] Subsequently, photographic subject brightness is detected by the brightness detection means 22 based on the image pick-up output of CCD13, and the detected photographic subject brightness is higher than predetermined brightness, is low, or (low brightness) is judged (S3). When judged with high brightness, mountain-climbing AF by the contrast method is performed by centering on 1st location 53 shown by active triangular ranging predetermined within the limits (S4). Contrast is sequential-migration-detected for lens 11a for focuses from an image pick-up output on each point to a total of six points centering on the 1st location 53 approximately, and, specifically, lens 11a is moved to the location where contrast serves as a peak. Thereby, as shown in drawing 2 , a positioning setup of the lens 11a is carried out in the location 54 used as the contrast peak 57 of the contrast curve 56. What is necessary is here, just to set it as the several times as many range as the amount of permission defocusing of a taking lens 11 as a predetermined range in mountain-climbing AF.

[0045] subsequently -- or the contrast of contrast which the contrast of a photographic subject was detected by the contrast detection means 21, and was detected based on the image pick-up output of CCD13 is higher than a predetermined value -- (O.K.) -- it is low or (NG) is judged (S5). When judged with O.K., it moves to photography actuation (S6).

[0046] When judged with low brightness in the brightness judging of S3, or when it is judged with NG in the contrast judging of S5, based on active triangular ranging data, lens 11a drives in the focus location (the 1st location) 53 like S2. Then, it will move to photography actuation of S6. That is, a focus will be performed by only the active triangular ranging method when the focus by the contrast method does not work.

[0047] On the other hand, flash plate MACHIKKU control which controls the amount of luminescence by this operation gestalt according to the distance to a photographic subject in control of a stroboscope is performed. Flash plate MACHIKKU control changes the amount of luminescence

of a stroboscope according to the distance to a photographic subject, and the stroboscope luminescence means 42 and the flash plate MACHIKKU control means 43 perform it as follows. That is, based on the distance signal acquired by the ranging means 30, adjustable [of the amount of luminescence of the stroboscope luminescence means 42] is carried out by the flash plate MACHIKKU control means 43, and the amount of the light irradiated by the photographic subject is controlled the optimal. In this case, without acting on depth of field, flash plate MACHIKKU control with a high precision can be performed, and it is suitable for the deep electronic camera of depth of field.

[0048] Although it is also possible to perform flash plate MACHIKKU control using a contrast method here, it is more desirable to use a triangular ranging method as mentioned above. Since the focus by the contrast method does not measure the distance to a photographic subject directly, in order to specify distance using a contrast method, after focusing, a certain data processing is needed. It is disadvantageous all the more in respect of speed because the contrast method needs data processing for the speed to a focus to be slow and use for flash plate MACHIKKU control further as compared with a triangular ranging method. Moreover, especially by the contrast method, since the depth of focus becomes deep at a wide angle side, although the focus of a lens suits, the situation where an exact distance cannot be specified produces it. On the other hand, a triangular ranging method is direct distance detection, and since detection speed is also still quicker, it can carry out flash plate MACHIKKU control to a high speed and high degree of accuracy by using this.

[0049] Moreover, it is a wide angle and looking-far side, and it is also possible to choose and use a triangular ranging method and a contrast method. As explained previously, when a taking lens 11 is set to a wide angle side rather than a predetermined value, flash plate MACHIKKU control of high degree of accuracy can be performed by performing flash plate MACHIKKU control of the stroboscope luminescence means 42 based on the distance signal acquired by the triangular ranging means 30, without being influenced by depth of field.

[0050] However, when a taking lens 11 is set to a looking-far side, if the triangular ranging means 30 is used, the amount of luminescence is insufficient and precision may be unable to be maintained. Then, when set to a looking-far side, based on the distance signal acquired based on the focus means by the contrast method, flash plate MACHIKKU control of the stroboscope luminescence means 42 is performed. Thereby, the flash plate MACHIKKU control with a high precision is attained at a looking-far side at a wide angle side.

[0051] In addition, although the amount of luminescence of a stroboscope may be controlled as flash plate MACHIKKU control according to the distance to a photographic subject as described above, you may make it instead control drawing of a taking lens according to the distance to a photographic subject. Furthermore, you may make it control these both.

[0052] Thus, according to this operation gestalt, focusing can be carried out to high degree of accuracy at high speed by using together an active triangular ranging method and a contrast method. By the active triangular ranging method, although it can focus at high speed, it cannot say that precision is enough, but on the other hand, with a contrast method, although it can focus to high degree of accuracy, it takes time amount. Then, focusing of a high speed and high degree of accuracy can be performed by using these two methods together, and an active triangular ranging method's performing coarse alignment, and performing accurate alignment with a contrast method.

[0053] Moreover, with this operation gestalt, in order to perform the focus by the contrast method from the image pick-up output of CCD13 for an image pick-up, it is not necessary to newly form an image sensor, and simplification of a configuration can be attained. Furthermore, in the ranging means 30, it becomes possible to carry out active triangular ranging to high degree of accuracy more by projecting a multiple-times infrared beam on a photographic subject, and measuring photographic subject distance based on the composite signal acquired as a result of projection of multiple times in one ranging actuation.

[0054] Moreover, based on the distance signal by the ranging means, by performing flash plate MACHIKKU control based on the distance signal by the contrast method, a wide angle side is crossed to all the ranges from a wide angle side to a looking-far side, and the flash plate MACHIKKU control of it with a high precision is attained by the looking-far side.

[0055] (2nd operation gestalt) Drawing 4 is drawing for explaining the concrete configuration of the

focus device in the electronic camera concerning the 2nd operation gestalt of this invention, and its principle of operation. In addition, the same sign is given to the same portion as drawing 2, and the detailed explanation is omitted.

[0056] The point that this operation gestalt differs from the 1st previous operation gestalt arranges the light sensing portion in the ranging means 30 on both sides of the floodlighting section, and is to have constituted the so-called both eyes AF. That is, in the ranging means 30, PSD(s) 32a and 32b are arranged in the symmetric position of the both sides of pair Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. at LED31, respectively, and the light-receiving lenses 35a and 35b are arranged to each PSD(s) 32a and 32b, respectively.

[0057] With the ranging means 30 of this operation gestalt, the light emitted from LED31 is irradiated by the photographic subject 50 through the floodlighting lens 34, and the floodlighting spot image 51 is formed on a photographic subject 50. This floodlighting spot image 51 is led by light-receiving lens 35a on PSD32a, light-receiving spot image 52a is formed, and that location is detected by PSD32a. The spot image 51 is led by light-receiving lens 35b on PSD32b, light-receiving spot image 52b is formed in coincidence, and the location is detected by PSD32b. And in the active triangular ranging control circuit 38, the distance to a photographic subject 50 is measured by equalizing each detection output of two PSD(s) 32a and 32b.

[0058] Drawing 5 (a) and (b) are the perspective diagrams showing the configuration of the focus device in this operation gestalt. LED31 and PSD(s) 32a and 32b are formed in the AF substrate 61 at one, and are attached in the case 62 equipped with the floodlighting lens 34 and the light-receiving lenses 35a and 35b. And it is arranged on the outside of the lens system for photography.

[0059] Moreover, in this example, the light 65 to which the pattern was attached is irradiated through the floodlighting lens 66 as a cure against the Rochon trust at a photographic subject, and the photographic subject image 67 at that time is picturized by CCD13. In this case, also when the contrast in a photographic subject is low, the focus by the contrast method is attained. As a means to irradiate the light to which the pattern was attached, it is (1). A pattern is formed in the LED itself.

(2) Arrange a grid pattern all over LED.

(3) Form a grid pattern in the lens itself.

****** may be adopted.

[0060] Here, if a spot chip arises in the light-receiving spot image 52 as shown in drawing 6 when the ranging means 30 as shown in said drawing 2 is used, measurement by the ranging means 30 will be out of order. If lens 11a is driven based on this mistaken measurement result and the focus by the contrast method is performed, in the successive range of lens 11a by the contrast method, a contrast peak will not be acquired but the situation which cannot perform an exact focus will arise.

[0061] On the other hand, with this operation gestalt, since PSD32 is arranged on both sides of LED31, the effect of a spot chip can be offset, and even if there is a spot chip, accurate ranging can be performed. Moreover, since the quantity of light doubles, improvement in S/N can also be aimed at.

[0062] (3rd operation gestalt) Drawing 7 is drawing showing the basic configuration of the active triangular ranging section in the electronic camera concerning the 3rd operation gestalt of this invention.

[0063] In active triangular ranging, the movement magnitude of the light-receiving spot location by change of a photographic subject location increases, so that the installation location of PSD is far from the lens shaft for photography to radial (sensitivity becomes high), and the movement magnitude of the light-receiving spot location by change of a photographic subject location decreases, so that it is near (sensitivity becomes low). It it arranges PSD in the location near a lens shaft, although measurement of a short distance is possible, sufficient sensitivity is not obtained to a long distance, but the measurement becomes impossible [measurement]. Although sensitivity sufficient also by long-distance measurement will be obtained if PSD is arranged in a location distant from a lens shaft, at close range, as for the movement magnitude of past [the high one] and spot light, reverse has [of stopping to be unable to cover by PSD] too much sensitivity.

[0064] On the other hand, with this operation gestalt, as shown in drawing 7 (a), system of measurement which is different with a short distance and a long distance, respectively is used. When a photographic subject location is near, the light which came out of LED31a on the left-hand side of

drawing 7 (a) is irradiated at a photographic subject, the reflected light is detected by PSD32a, the light which came out of LED31b on the right-hand side of drawing 7 (a) when a photographic subject location was far is irradiated at a photographic subject, and the reflected light is detected by PSD32b. Thereby, highly sensitive measurement is attained irrespective of a photographic subject location.

[0065] Moreover, as shown in drawing 7 (b), by devising the arrangement location of LED 31a and 31b and PSD32, PSD32 can be set to one and the light-receiving lens 35 can be shared by two system of measurement.

[0066] (4th operation gestalt) Drawing 8 is a flow chart which shows focus actuation of the electronic camera concerning the 4th operation gestalt of this invention.

[0067] With this operation gestalt, although the configuration of an electronic camera and a focusing device is the same as that of the 1st operation gestalt, the lens migration locations in the coarse control by the ranging means differ. That is, speeding up of the focus actuation by the contrast method is attained by making it move to the location of a front focus or rear focusing rather than making it move to a focus location by active triangular ranging.

[0068] With this operation gestalt, if release of the electronic camera is carried out first, active triangular ranging will be performed like the 1st operation gestalt (drawing 2) (S1). Subsequently, photographic subject brightness is detected by the brightness detection means 22 based on the image pick-up output of CCD13, and the detected photographic subject brightness is higher than predetermined brightness, is low, or (low brightness) is judged (S2). When judged with high brightness, based on ranging data, lens 11a for focuses drives by the lens driving means 14, and lens 11a is set to the 2nd different location from a focus location (the 1st location) (S3). This 2nd location is a location of a front focus or rear focusing more slightly than the 1st location.

[0069] Subsequently, mountain-climbing AF by the contrast method is performed by moving lens 11a by making into the starting point the 2nd location obtained by the active triangular ranging means 22 (S4). Here, lens 11a can be promptly set as a contrast peak location by moving lens 11a in the direction of CCD to the focus location of active triangular ranging, if it is a front focus, and it is rear focusing in the direction of a photographic subject about lens 11a. That is, the migration direction of the beginning of lens 11a can be set to the side which a focus suits, processing until it finds a contrast peak can be simplified, and focus actuation can be performed quickly.

[0070] Although contrast may become low by migration of the first lens 11a when lens 11a is set to a focus location with a ranging signal, the migration direction of lens 11a must be made into reverse in this case. On the other hand, since contrast always becomes high by migration of the beginning of lens 11a like this operation gestalt by setting lens 11a to the location of a front focus or rear focusing with a ranging signal, useless migration can be lost and mountain-climbing AF can be performed quickly.

[0071] Moreover, as for the amount of a front focus or rear focusing, it is desirable to set it as the degree to which a photographic subject image fades slightly, and the degree which the rise of contrast can specifically distinguish certainly by the first migration in near and mountain-climbing AF which follows in a focus location comparatively. Since the amount of dotage by the front focus or rear focusing changes with the focal distance and lens drawing value of a taking lens, when the amount of a front focus or rear focusing is similarly set up, the amount of dotage at the time of the focus actuation initiation by the contrast method will change by the focal distance and lens drawing value change of a taking lens. Therefore, it is desirable to carry out an adjustable setup of the amount of a front focus or rear focusing according to the focal distance and lens drawing value of a taking lens so that the amount of dotage at the time of the focus actuation initiation by the contrast method may become always the same. In this case, it becomes possible to lessen useless migration more and to perform mountain-climbing AF more quickly.

[0072] subsequently -- or the contrast which the contrast of a photographic subject was detected by the contrast detection means 21, and was detected based on the image pick-up output of CCD13 is higher than a predetermined value -- (O.K.) -- it is low or (NG) is judged (S5). When judged with O.K., it moves to photography actuation (S6).

[0073] When judged with low brightness in the brightness judging of S2, or when it is judged with NG in the contrast judging of S5, lens 11a drives in the 1st location which is a focus location based

on active triangular ranging data. Then, it will move to photography actuation of S6. That is, a focus will be performed by only the active triangular ranging method when the focus by the contrast method does not work.

[0074] Thus, with this operation gestalt, since it is made to perform focus actuation by the contrast method after moving lens 11a for focuses to the location of not the focus location by active triangular ranging but a front focus, or rear focusing, it becomes possible to perform focus actuation by the contrast method quickly, and high-speed focusing becomes more possible.

[0075] (5th operation gestalt) Drawing 9 is a flow chart which shows the automatic-focusing control action of the electronic camera concerning the 5th operation gestalt of this invention.

[0076] With this operation gestalt, although the configuration of an electronic camera and a focusing device is the same as that of the 1st operation gestalt, the lens passing speed in two steps of focuses is changed. That is, when making it move to a focus location by active triangular ranging, lens passing speed is made quick, and when making it move to the focus location by the contrast method, lens passing speed is made late.

[0077] First, if release of the camera is carried out, active triangular ranging will be performed like the 1st operation gestalt (drawing 2) (S1). And based on ranging data, lens 11a for focuses drives with the 1st passing speed V1 by the lens driving means 14, and lens 11a is set to the focus location (the 1st location) 53 (S2).

[0078] Subsequently, like the 1st operation gestalt, photographic subject brightness is detected by the brightness detection means 22 based on the image pick-up output of CCD13, and the detected photographic subject brightness is higher than predetermined brightness, is low, or (low brightness) is judged (S3). When judged with high brightness, mountain-climbing AF by the contrast method is performed by centering on 1st location 53 shown by active triangular ranging predetermined within the limits (S4). At this time, lens 11a is moved with the 2nd passing speed V2 (V2<V1) later than the 1st passing speed V1. Thereby, lens 11a is set to the location used as a contrast peak, i.e., a focus location.

[0079] subsequently -- or the contrast of contrast which the contrast of a photographic subject was detected by the contrast detection means 21, and was detected based on the image pick-up output of CCD13 is higher than a predetermined value -- (O.K.) -- it is low or (NG) is judged (S5). When judged with O.K., it moves to photography actuation (S6).

[0080] When judged with low brightness in the brightness judging of S3, or when it is judged with NG in the contrast judging of S5, like S2, based on active triangular ranging data, lens 11a drives with the 1st passing speed V1, and is set as the focus location (the 1st location) 53. Then, it will move to photography actuation of S6.

[0081] Thus, with this operation gestalt, by making lens passing speed quick, much more improvement in the speed can be timed, and much more high-degree-of-accuracy-ization can be achieved by making lens passing speed late by the fine control by the contrast method by the coarse control by active triangular ranging.

[0082] (6th operation gestalt) Drawing 10 is a flow chart which shows focusing actuation of the electronic camera concerning the 6th operation gestalt of this invention.

[0083] With this operation gestalt, although the configuration of an electronic camera and a focusing device is the same as that of the 1st operation gestalt, the lens migration locations in the coarse control by the ranging means differ, and the lens passing speed in two more steps of focuses is changed. That is, the 4th operation gestalt and the 5th operation gestalt are combined.

[0084] First, if release of the electronic camera is carried out, active triangular ranging will be performed like the 1st operation gestalt (drawing 2) (S1). Subsequently, photographic subject brightness is detected by the brightness detection means 22 based on the image pick-up output of CCD13, and the detected photographic subject brightness is higher than predetermined brightness, is low, or (low brightness) is judged (S2). When judged with high brightness, based on ranging data, lens 11a for focuses drives at the 1st drive speed V1 by the lens driving means 14, and lens 11a is set to the 2nd different location from the focus location (the 1st location) by triangular ranging (S3). This 2nd location is a location of a front focus or rear focusing more slightly than the 1st location.

[0085] Subsequently, mountain-climbing AF by the contrast method is performed by moving lens 11a by making into the starting point the 1st location shown by active triangular ranging (S4). At this

time, lens 11a is moved with the 2nd passing speed V2 (V2<V1) later than the 1st passing speed V1.
[0086] Here, to the focus location by active triangular ranging, if it is a front focus, and it is rear focusing in the direction of a photographic subject about lens 11a, lens 11a can be promptly set as a contrast peak location by moving lens 11a in the direction of CCD. That is, the migration direction of the beginning of lens 11a can be set to the side which a focus suits, processing until it finds a contrast peak can be simplified, and focus actuation can be performed quickly.
[0087] subsequently -- or the contrast of contrast which the contrast of a photographic subject was detected by the contrast detection means 21, and was detected based on the image pick-up output of CCD13 is higher than a predetermined value -- (O.K.) -- it is low or (NG) is judged (S5). When judged with O.K., it moves to photography actuation (S6).
[0088] When judged with low brightness in the brightness judging of S2, or when it is judged with NG in the contrast judging of S5, based on active triangular ranging data, lens 11a drives with the 1st passing speed V1, and is set as the 1st location which is a focus location by triangular ranging. Then, it will move to photography actuation of S6. That is, a focus will be performed by only the active triangular ranging method when the focus by the contrast method does not work.
[0089] Thus, with this operation gestalt, since it is made to perform focus actuation by the contrast method like the 4th operation gestalt after moving lens 11a for focuses to the location of not the focus location by active triangular ranging but a front focus, or rear focusing, it becomes possible to perform focus actuation by the contrast method quickly, and high-speed focusing becomes more possible. Moreover, like the 5th operation gestalt, by making lens passing speed quick, much more improvement in the speed can be timed, and much more high-degree-of-accuracy-ization can be achieved by making lens passing speed late by the fine control by the contrast method by the coarse control by active triangular ranging.
[0090] (7th operation gestalt) Drawing 11 is drawing showing the important section configuration of the electronic camera concerning the 7th operation gestalt of this invention. In addition, the same sign is given to the same portion as the 1st operation gestalt (drawing 1), and the detailed explanation is omitted.
[0091] The point that this operation gestalt differs from the 1st operation gestalt forms the factice CPU 70 who has means of communications 71, and is to have enabled actuation of the ranging means 30 independently.
[0092] Drawing 12 is a flow chart which shows the focus actuation in this operation gestalt.
[0093] First, it is confirmed by check period 10msec whether the touch sensor attached to the release carbon button of a camera turned on (S1). Electric power will be supplied by cameras (CCD etc.) if having been touched is detected. And a photometry is performed (S2) and WB (white balance) is adjusted further (S3).
[0094] Subsequently, if 1st release (the shutter switch is two steps and the case where the case where it pushes shallowly is pushed to 1st release and the last will be called 2nd release) serves as ON, active triangular ranging will be performed (S5). This active triangular ranging compounds and equalizes the detection data based on 16 floodlighting.
[0095] Subsequently, based on a triangular ranging output, lens 11a is moved to this side (front focus) of a focus location (S6). Then, with a contrast method, the peak of contrast is detected in six frames and lens 11a is moved to a peak location (S7). And it judges whether peak detection succeeded (S8).
[0096] Here, in parallel to the lens migration based on the above-mentioned triangular ranging output, and the focus actuation by the contrast method, active triangular ranging for the second time is performed. In this active triangular ranging, since the focus actuation by the contrast method is slow, ranging by floodlighting is performed 3 times 16 times, ranging and 4 times in all of the ranging data based on S5 are integrated, distance is calculated from an addition output, and the distance to a photographic subject is measured (S9). Since this parallel processing has formed the factice CPU 70 as shown in said drawings 11, it becomes possible.
[0097] When the peak detection in S8 is NG, lens 11a is driven based on the ranging data in S9 (S10). That is, when the focus by the contrast method does not work, it will focus based on 4 times of the ranging data (64 times floodlighting data) based on triangular ranging. Moreover, when the peak detection in S8 is O.K., after performing focus actuation by S10 further, the flash plate

MACHIKKU operation by floodlighting data is performed 64 times (S11). Thereby, according to the distance to a photographic subject, the amount of luminescence of a stroboscope is controlled the optimal.

[0098] And while 1st release has been in ON condition, when (S12) and also 2nd release also serve as ON, (S13) and photography are started (S14). In S12, if 1st release serves as OFF, it will return to a start. When 1st release is [2nd release] OFF in ON, it waits until 2nd release turns on.

[0099] Thus, according to this operation gestalt, focusing can be carried out to high degree of accuracy at high speed by using together an active triangular ranging method and a contrast method like the 1st operation gestalt. Furthermore, in order to perform the focus by the contrast method from the image pick-up output of CCD13 for an image pick-up, it is not necessary to newly form an image sensor, and simplification of a configuration can be attained.

[0100] Since the output signal acquired by triangular ranging (a total of 4 times of ranging by 16 times floodlighting) of multiple times is integrated with this operation gestalt in addition to these, based on the good output signal of S/N, the distance signal of high degree of accuracy can be acquired, and flash plate MACHIKKU control with a high precision can be performed. Moreover, since focus actuation will be performed based on the distance signal of the high degree of accuracy acquired by triangular ranging of multiple times when the focus by the contrast method does not work, focusing can be carried out to high degree of accuracy rather than the case where it is based on 1 time of triangular ranging. Moreover, since the infrared beam of multiple times is irradiated at a photographic subject and active triangular ranging is performed while driving the lens based on the focus means by the contrast method, there is also no un-arranging -- the whole ranging time amount becomes long.

[0101] In addition, this invention is not limited to each operation gestalt mentioned above, it is the range which does not deviate from the summary, and can deform variously and can be carried out.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the important section configuration of the electronic camera concerning the 1st operation gestalt.
[Drawing 2] Drawing for explaining the concrete configuration of the focus device in the 1st operation gestalt, and its principle of operation.
[Drawing 3] The flow chart which shows the focus actuation in the 1st operation gestalt.
[Drawing 4] Drawing for explaining the concrete configuration of the focus device in the electronic camera concerning the 2nd operation gestalt, and its principle of operation.
[Drawing 5] The perspective diagram showing the configuration of the focus device in the 2nd operation gestalt.
[Drawing 6] Drawing for explaining a problem when a spot chip arises in a light-receiving spot image.
[Drawing 7] Drawing showing the basic configuration of the active triangular ranging section in the electronic camera concerning the 3rd operation gestalt.
[Drawing 8] The flow chart which shows focus actuation of the electronic camera concerning the 4th operation gestalt.
[Drawing 9] The flow chart which shows focus actuation of the electronic camera concerning the 5th operation gestalt.
[Drawing 10] The flow chart which shows focus actuation of the electronic camera concerning the 6th operation gestalt.
[Drawing 11] Drawing showing the important section configuration of the electronic camera concerning the 7th operation gestalt.
[Drawing 12] The flow chart for explaining the 7th the focus actuation and flash plate MACHIKKU control in an operation gestalt.
[Description of Notations]
10 -- Taking lens
12 -- Lens drawing
13 -- Solid state image sensor (CCD)
14 -- Lens driving means
15 -- Zoom driving means
16 -- Throttling control means
20 -- Digital process circuit
21 -- Contrast detection means
22 -- Brightness detection means
30 -- Ranging means
31 -- Infrared rays LED
32 -- Location sensing element (PSD)
34 -- Floodlighting lens
35 -- Light-receiving lens
38 -- Active triangular ranging circuit
41 -- System controller
42 -- Stroboscope luminescence means

43 -- Flash plate MACHIKKU control means
44 -- LCD
45 memory cards
50 -- Photographic subject
51 -- Floodlighting spot image
52 -- Light-receiving spot image
53 -- Focus location by active triangular ranging
54 -- Focus location by mountain-climbing AF
55 -- infinity photographic subject focus location
56 -- Contrast curve
57 -- Contrast peak
61 -- AF substrate
62 -- Case
65 -- Light to which the pattern was attached
66 -- Floodlighting lens
67 -- Photographic subject image

[Translation done.]

* NOTICES *

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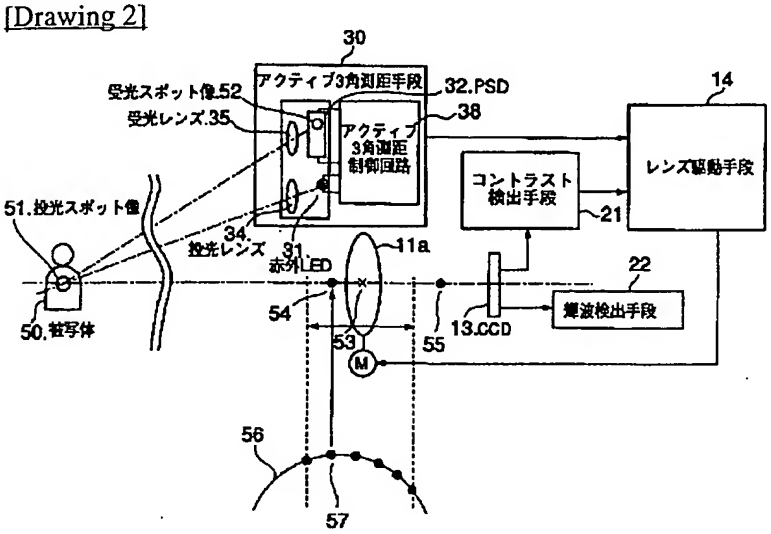
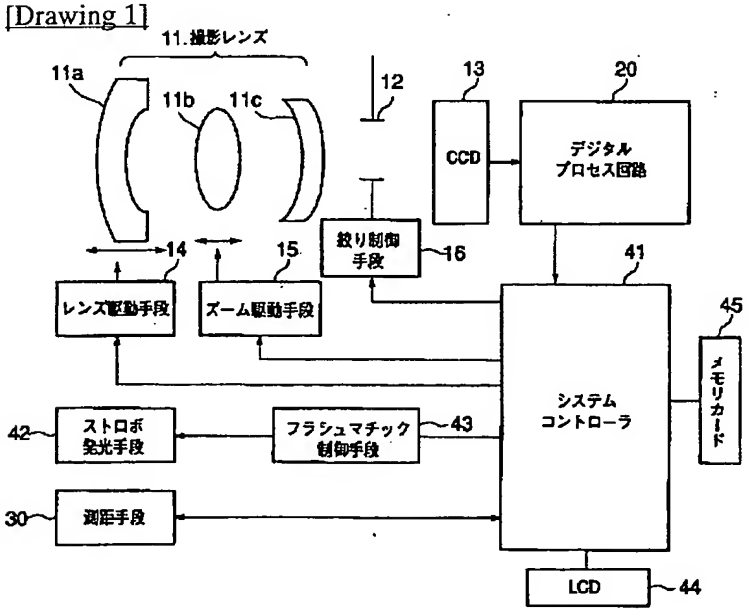
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

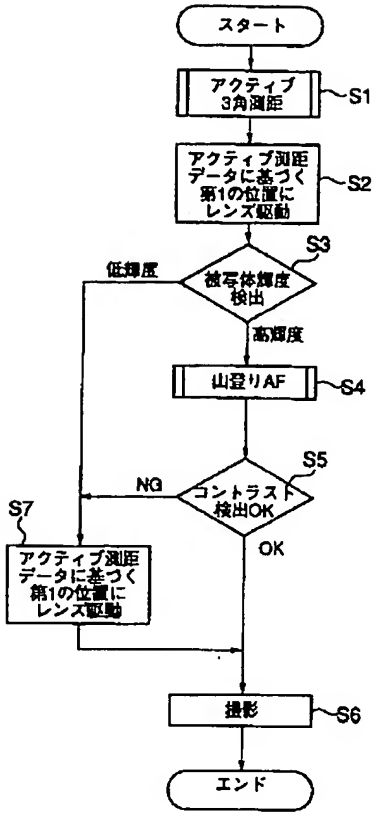
[Drawing 2]



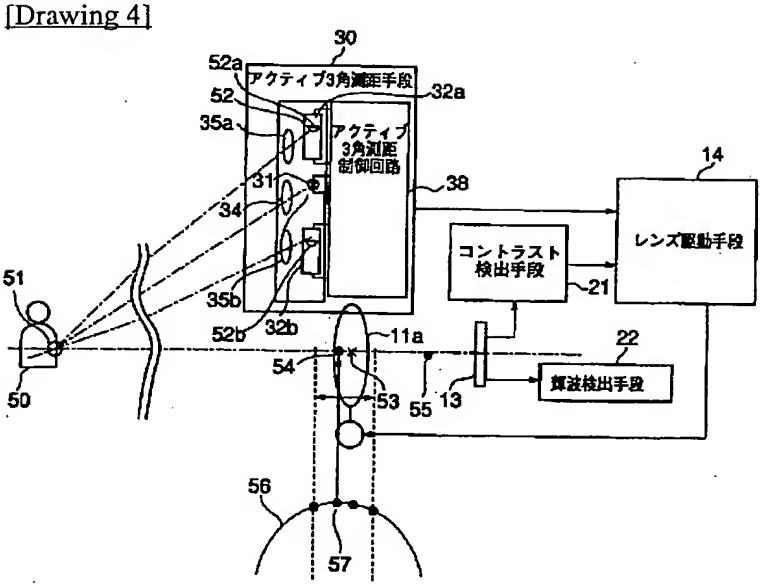
[Drawing 1]



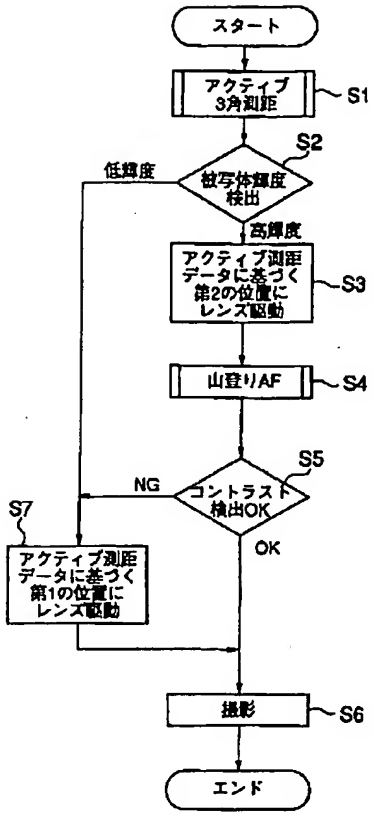
[Drawing 3]



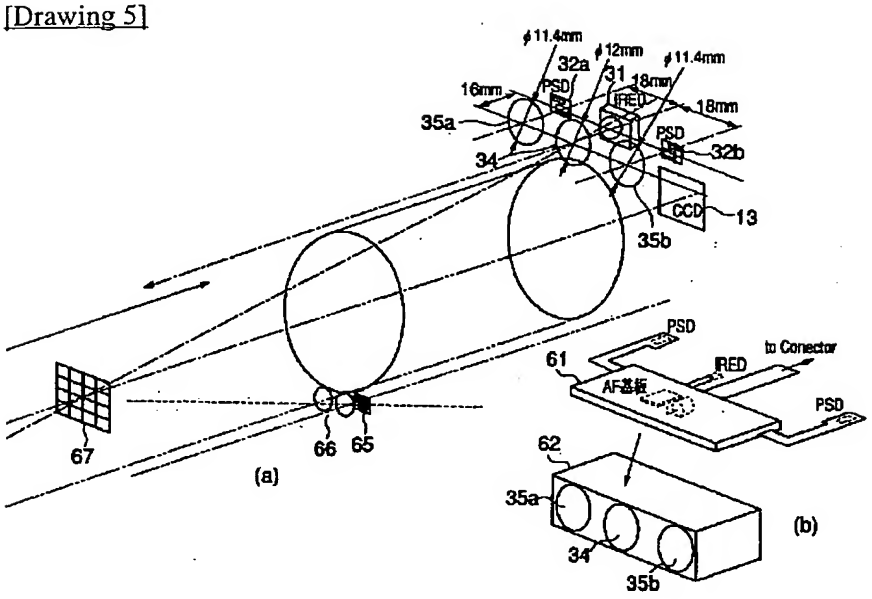
[Drawing 4]



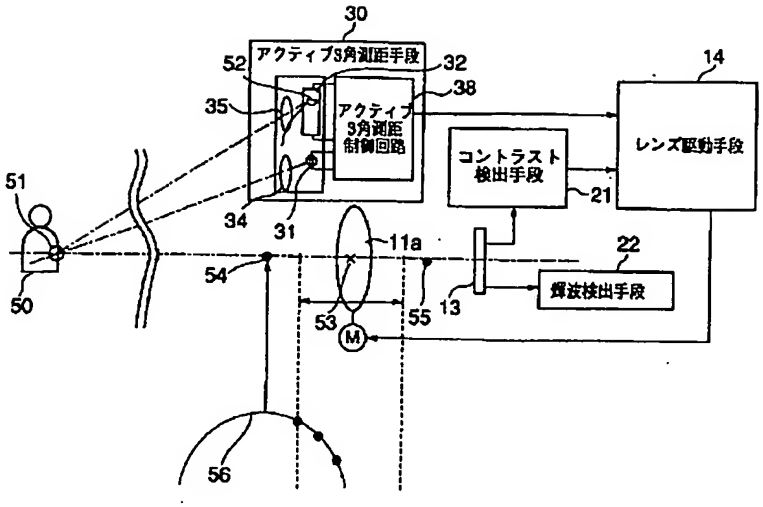
[Drawing 8]



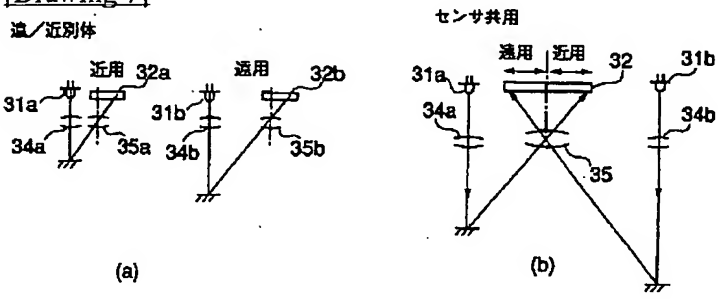
[Drawing 5]



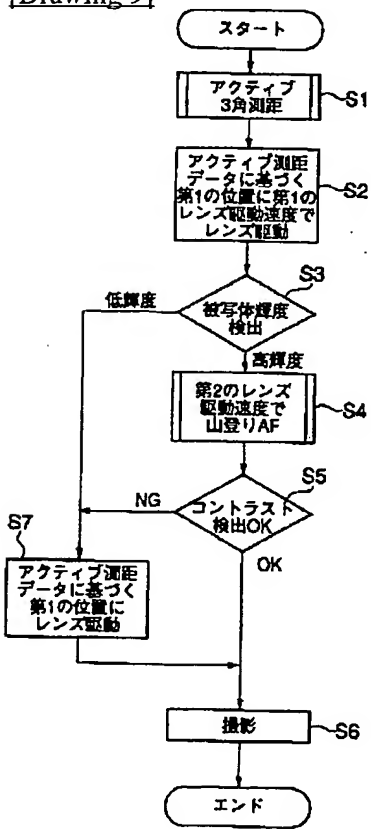
[Drawing 6]



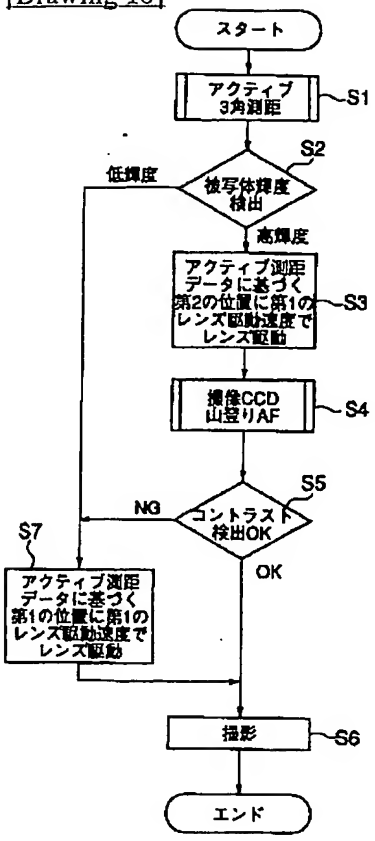
[Drawing 7]



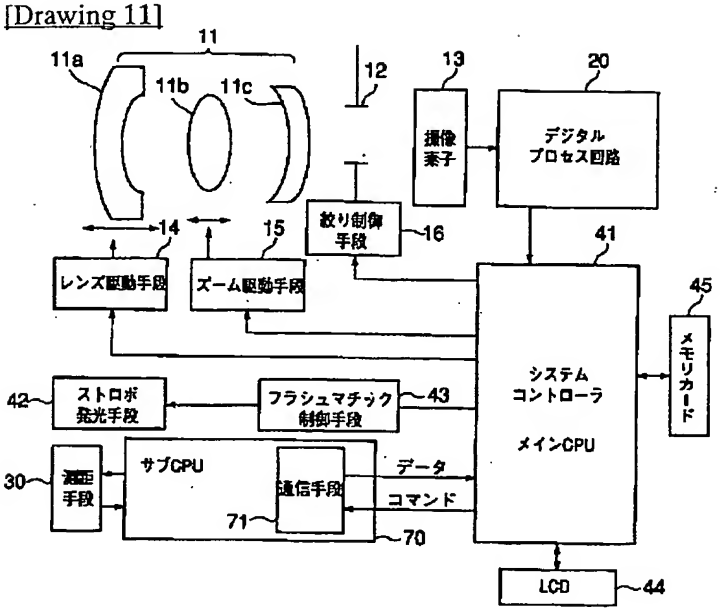
[Drawing 9]



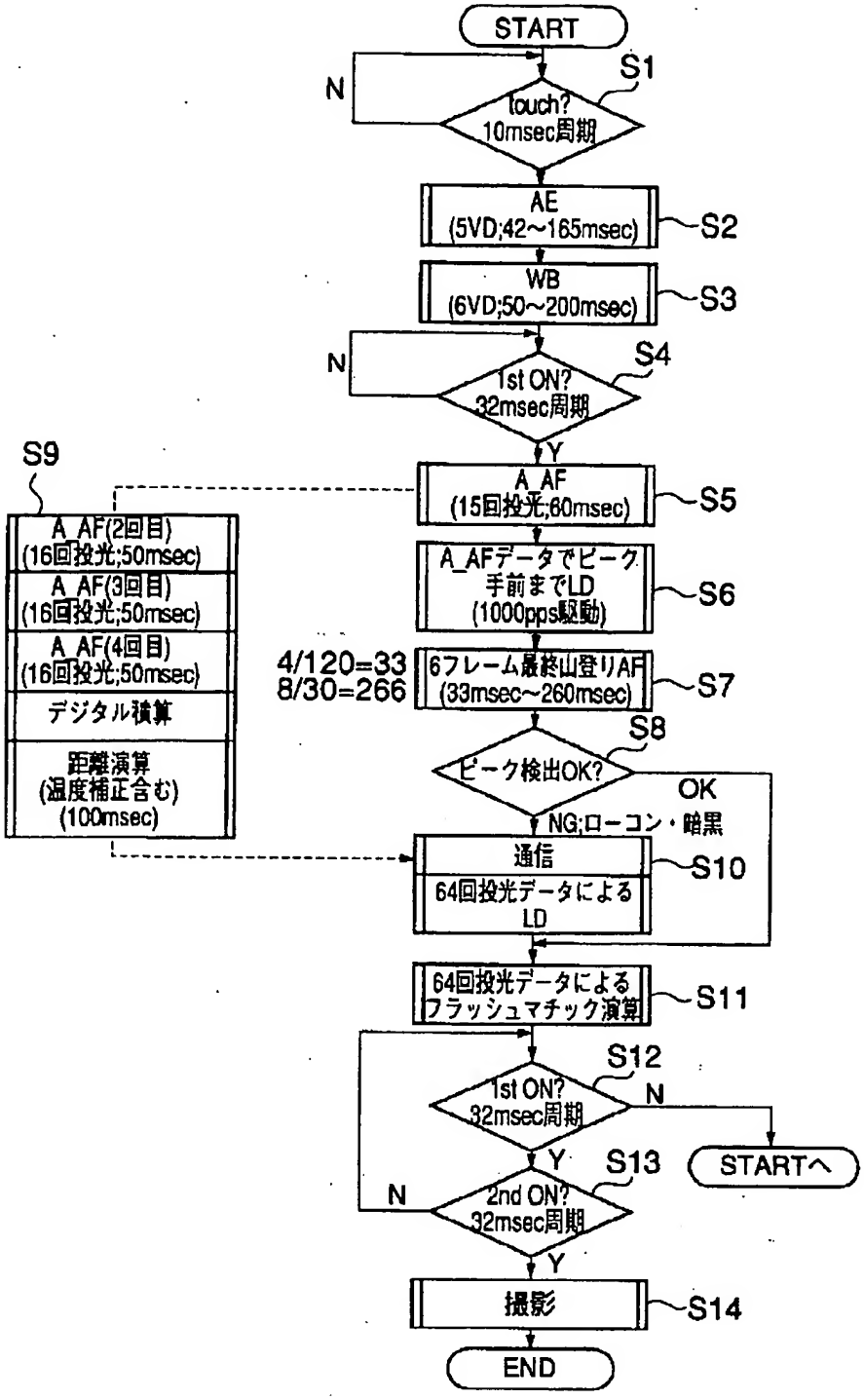
[Drawing 10]



[Drawing 11]



[Drawing 12]



[Translation done.]